AMENDMENT

(under Article 34)
(Translation)

To : Examiner of the Patent Office

1 Identification of the International Application
PCT/JP03/07521

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4 Item to be Amended Claims

5 Subject Matter of Amendment
As per the attached sheets, where
(1) claim 3 is added, so pages 22 and 23 of CLAIMS are replaced with new pages.

6 List of Attached Documents
(1) Pages 22 and 23 of CLAIMS

CLAIMS

1. A valve-regulated lead-acid battery comprising:

an electrode plate group; and

an electrolyte impregnated into and retained by said electrode plate group,

said electrode plate group comprising:

positive electrode plates that each include a positive electrode current collector comprising a Sn-containing lead alloy, and a positive electrode active material retained by said positive electrode current collector;

negative electrode plates that each include a negative electrode current collector comprising a lead alloy, and a negative electrode active material retained by said negative electrode current collector; and

separators,

wherein Sn content in said positive electrode current collector is 1.1 to 3.0 % by mass, and pore volume per unit mass of said negative electrode active material is 0.115 to 0.150 cm^3/g, and

part of said electrolyte is a free electrolyte that is free from said electrode plate group, and said free electrolyte is in contact with said separators.

2. The valve-regulated lead-acid battery in accordance with claim 1, wherein the Sn content in said positive electrode current collector is 1.6 to 2.5 % by mass.

3. (Added) A valve-regulated lead-acid battery comprising a battery set, said battery set comprising a plurality of unit batteries that are connected in series, said unit batteries each comprising:

an electrode plate group; and

an electrolyte impregnated into and retained by said electrode plate group,

said electrode plate group comprising:

positive electrode plates that each include a positive electrode current collector comprising a Sn-containing lead alloy, and a positive electrode active material retained by said positive electrode current collector;

negative electrode plates that each include a negative electrode current collector comprising a lead alloy, and a negative electrode active material retained by said negative electrode current collector; and

separators,

wherein Sn content in said positive electrode current collector is 1.1 to 3.0 % by mass, and pore volume per unit mass of said negative electrode active material is 0.115 to 0.150 cm^3/g, and

part of said electrolyte is a free electrolyte that is free from said electrode plate group, and said free electrolyte is in contact with said separators.

REPLY
(Translation)

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4 Date of Notification 20. 04. 04

5 Subject matter of Reply

(1) As to the content of PCT Written Opinion

In PCT Written Opinion dated April 20, 2004, there is written an opinion out that the inventions according to claims 1 and 2 of the present application do not have an inventive step.

However, we believe that the inventions according to claims 1 and 2 of the present application are inventive for the following reasons.

Further, we have added claim 3 in Amendment filed on the same day as this Reply. We believe that the invention according to claim 3 is also inventive.

(2) As to the present invention

The present invention relates to "A valve-regulated lead-acid battery comprising: an electrode plate group; and an electrolyte impregnated into and retained by said electrode plate group, said electrode plate group comprising: positive electrode plates that each include a positive electrode current collector comprising a Sn-containing lead alloy, and a positive electrode active material retained by said positive electrode current collector; negative electrode plates that each include a negative electrode current collector comprising a lead alloy, and a negative electrode active material retained by said negative electrode current collector; and separators, wherein Sn content in said positive electrode current collector is 1.1 to 3.0 % by mass, and pore volume per unit mass of said negative electrode active material is 0.115 to 0.150 cm^3/g, and part of said electrolyte is a free electrolyte that is free from said electrode plate group, and said free electrolyte is in contact with said separators." (claim 1), and "A valve-regulated lead-acid battery comprising a battery set, said battery set comprising a plurality of unit batteries that are connected in series, said unit batteries each comprising: an

electrode plate group; and an electrolyte impregnated into and retained by said electrode plate group, said electrode plate group comprising: positive electrode plates that each include a positive electrode current collector comprising a Sn-containing lead alloy, and a positive electrode active material retained by said positive electrode current collector; negative electrode plates that each include a negative electrode current collector comprising a lead alloy, and a negative electrode active material retained by said negative electrode current collector; and separators, wherein Sn content in said positive electrode current collector is 1.1 to 3.0 % by mass, and pore volume per unit mass of said negative electrode active material is 0.115 to 0.150 cm^3/g, and part of said electrolyte is a free electrolyte that is free from said electrode plate group, and said free electrolyte is in contact with said separators." (claim 3).

(3) As to Amendment

New claim 3 is added based on the description of line 3 from the bottom of page 4 to line 1 of page 5 of the present specification, and the description of page 9 and subsequent pages of Examples 2 and 3 and Table 1. New claim 3 recites the valve-regulated lead-acid battery including a battery set, the battery set including a plurality of unit batteries that are connected in series.

(4) As to the inventiveness of the present invention

The present invention relates to a valve-regulated lead-acid battery wherein the Sn content in the positive electrode current collector is 1.3 to 3.0 % by mass, and the pore volume per unit mass of the negative electrode active material is 0.115 to 0.150 cm^3/g, and part of the electrolyte is a free electrolyte that is free from the electrode plate group.

Accordingly, the oxygen gas absorption reaction of the negative electrode is stabilized, and the corrosion

resistance of the positive electrode is improved, so that the trickle life is improved. Also, since part of the electrolyte exists as a free electrolyte, the variations in the gas absorption reaction in the negative electrode are suppressed.

When a plurality of the above-mentioned batteries are connected as unit batteries in series for use as a battery set (claim 3), in particular, the variations in the charge voltages of the batteries are suppressed. Therefore, the present invention produces the effect of improving the life of a battery set.

In contrast, Document 1 (JP8-339819 A) discloses that in a sealed lead-acid battery, the apparent density of the separator is set to 160 to 190 g/l, the apparent density of the negative electrode active material to 3.6 to 4.3 g/cc, and the Sn content in the positive electrode grid made of a Pb-Ca-Sn alloy to 1.4 to 2.4 % by weight, in order to reduce trickle charge current and improve trickle life.

However, since Document 1 discloses a sealed lead-acid battery that is designed to include no free electrolyte, it does not suggest the technical concept of the present invention.

Also, Document 2 (JP 61-80769 A) discloses that a free electrolyte is provided under the electrode plate group, in order to suppress the loss of the electrolyte during trickle charge and improve life.

However, Document 2 does not disclose or suggest the present invention's effect of suppressing the variations in oxygen gas absorption reaction in the negative electrode.

Further, Documents 1 and 2 do not disclose or suggest a battery set comprising a plurality of batteries that are connected in series. Nor do they disclose or suggest the present invention's effects of suppressing the variations in the charge voltages of the batteries and thereby improving

the life of the battery set.

As described above, one with ordinary skill in the art would not be motivated to combine Document 1, which is designed to include no free electrolyte, with Document 2, which includes a free electrolyte as an essential element. In addition, a mere combination of Documents 1 and 2 would not result in a battery set. Therefore, one with ordinary skill in the art cannot easily arrive at the present invention having the above-described effects by combining Documents 1 and 2 that do not disclose or suggest the present invention's effect of improving the life of a battery set.

(5) Conclusion

For the above reasons, we believe that the inventions described in claims 1 to 3 have an inventive step.

Therefore, we would like to request an affirmative International Preliminary Examination Report to be prepared with respect to the novelty, the inventiveness, and the industrial applicability of the present invention.